Assignment

Generic Elective

Physical Chemistry, Ist year

Semester II (2020)

Chemical Kinetics

1. For a reaction
   $C_2H_5I + OH^- \rightarrow C_2H_5OH + I^-$
   the rate constant was found to have a value of 5.03×10^{-2} mol^{-1} dm^3 s^{-1} at 298 K and 6.71 mol^{-1} dm^3 s^{-1} at 333 K. What is the activation energy of the reaction ? What is the rate constant at 305 K?

2. Show that for a first –order reaction, the time required for 99.9% completion of the reaction is 10 times that required for 50% completion of the reaction.

3. The inactivation of the viral preparation in a chemical bath is found to be a first-order reaction. (a) Calculate the rate constant for the viral activation if in the beginning 1.5% of the virus is inactivated per minute. (b) Calculate the time required for 50% inactivation.

4. Derive an expression for the half-life, $t_{1/2}$ of an nth order reaction for n ≥ 2, to be as $t_{1/2} = \frac{2^{(n-1)} - 1}{k_n\,(n-1)a_0^{n-1}}$.

5. The $t_{1/2}$ of a reaction is halved as the initial concentration of the reactant is doubled. What is the order of the reaction?

6. The rate constant for the first-order decomposition of ethylene oxide into CH_4 and CO follows the equation: log k (in sec^{-1}) = 14.34 – (1.25× 10^4 K)/T. Calculate (a) the activation energy of the reaction (b) the rate constant at 700 K and (c) frequency factor, A.